

## APPENDIX 1 / LAMPIRAN 1

**Fundamental Equations in Vibration**

$$1. \quad \zeta = \frac{c}{2m\omega_n};$$

$$2. \quad x(t) = Ce^{-\zeta\omega_n t} \sin(\omega_d t + \psi), \quad \omega_d = \sqrt{1 - \zeta^2}\omega_n$$

$$C = \sqrt{x_0^2 + \frac{(\dot{x}_0 + \zeta\omega_n x_0)^2}{(1 - \zeta^2)\omega_n^2}} \quad ; \quad \psi = \tan^{-1} \frac{\sqrt{1 - \zeta^2}\omega_n x_0}{\dot{x}_0 + \zeta\omega_n x_0}$$

$$3. \text{ For } F(t) = me\omega^2 \sin \omega t$$

$$X = \frac{me\omega^2}{\sqrt{(k - M\omega^2)^2 + (c\omega)^2}}, \quad \phi = \tan^{-1} \left[ \frac{c\omega}{k - M\omega^2} \right]$$

$$\frac{F_T}{F_0} = \left[ \frac{1 + (2\zeta r)^2}{(1 - r^2)^2 + (2\zeta r)^2} \right]^{1/2}$$

$$4. \text{ For } y = Y \sin \omega t,$$

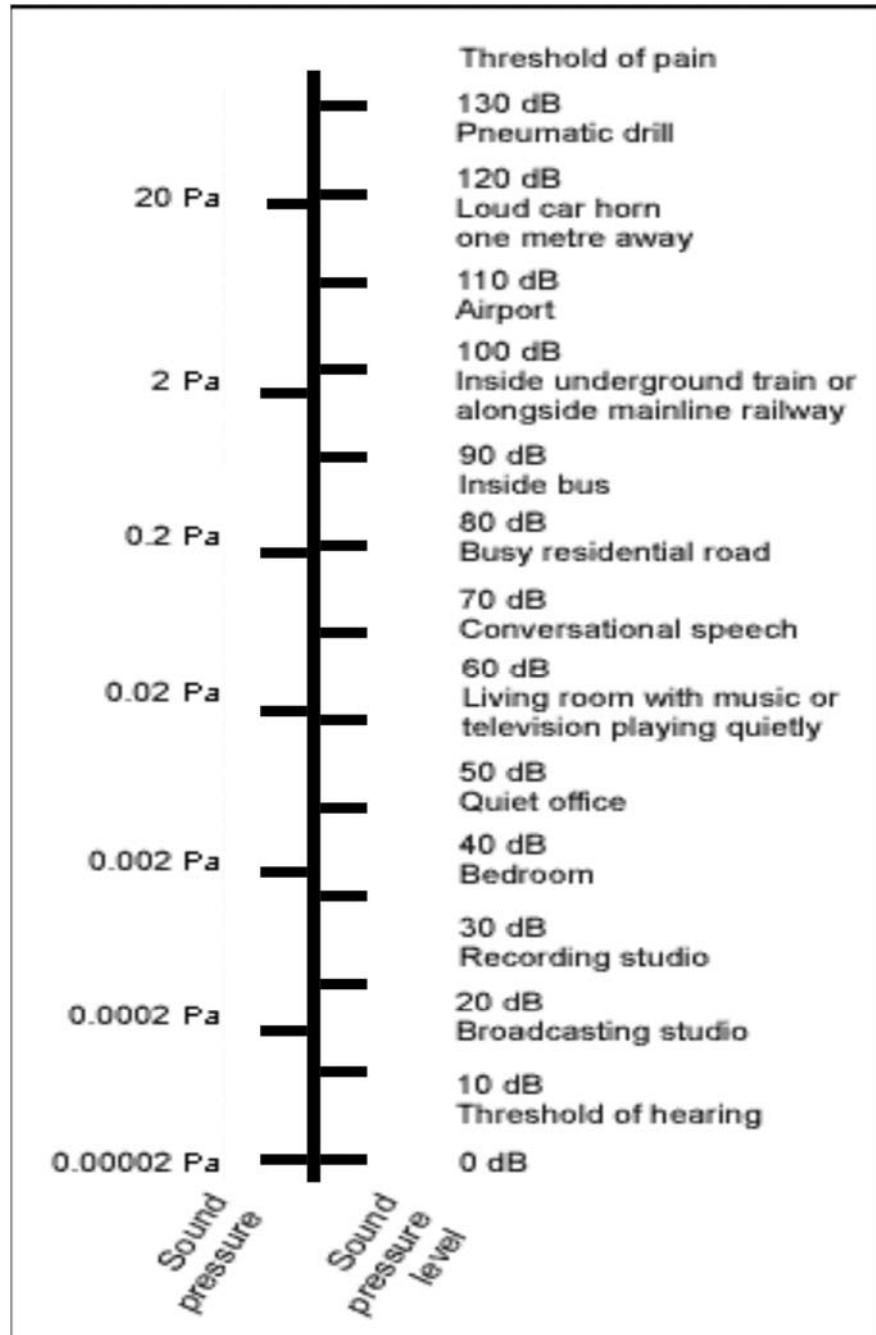
$$\frac{X}{Y} = \left[ \frac{1 + (2\zeta r)^2}{(1 - r^2)^2 + (2\zeta r)^2} \right]^{1/2} \quad \phi = \tan^{-1} \left[ \frac{2\zeta r^3}{1 + (4\zeta^2 - 1)r^2} \right]$$

$$\frac{F_T}{kY} = r^2 \left[ \frac{1 + (2\zeta r)^2}{(1 - r^2)^2 + (2\zeta r)^2} \right]^{1/2}$$

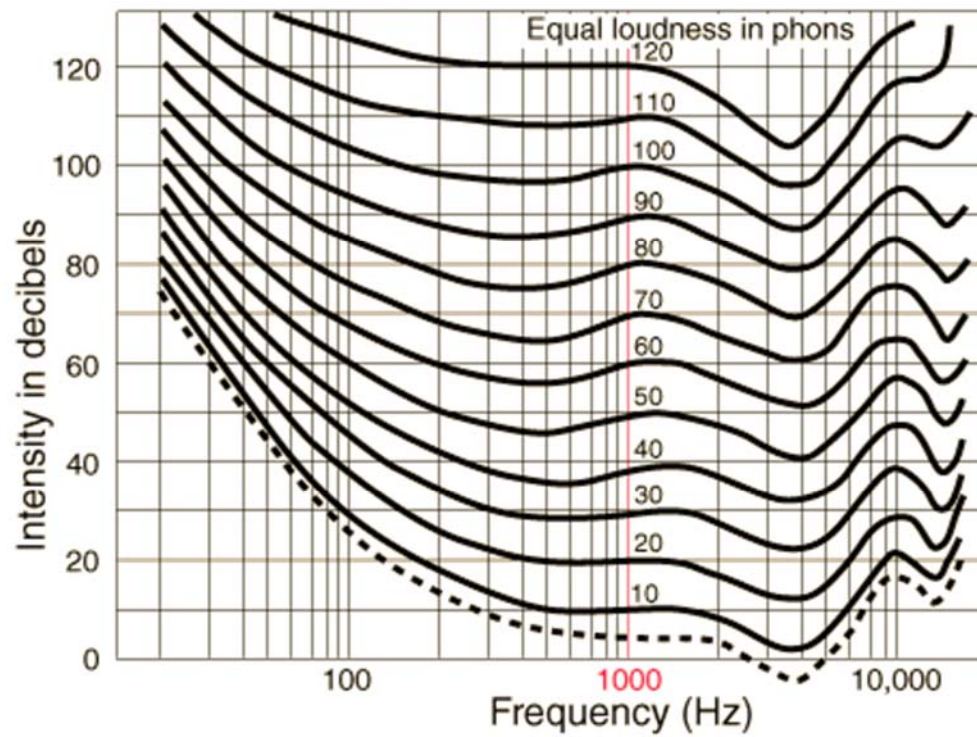
$$5. \quad \begin{pmatrix} a & b \\ c & d \end{pmatrix}^{-1} = \begin{pmatrix} d & -b \\ -c & a \end{pmatrix} \frac{1}{\Delta(\omega)} \quad ; \quad \det \begin{pmatrix} a & b \\ c & d \end{pmatrix} = ad - bc$$

$$6. \text{ For cantilever beam with load } P \text{ at the free end, } \delta_{\max} = PL^3(3EI)^{-1}$$

$$7. \text{ For cantilever beam with uniform load } w, \delta_{\max} = wL^4(8EI)^{-1}$$

Sound Pressure Level**Figure Q5[a]: Sound Pressure Level***Rajah S5[a]: Paras Tekanan Bunyi*

## APPENDIX 3 / LAMPIRAN 3



**Figure Q5[c]: Equal Loudness Curves**  
*Rajah S5[c]: Lengkungan Sama Nyaring*

APPENDIX 4 / *LAMPIRAN 4***Energy Attenuation Constant for Air****(a) 4m (1/ft)**

Relative Humidity	Temperature °C(°F)	2,000 Hz	4,000 Hz	6,300 Hz	8,000 Hz
30%	15 (59)	0.0044	0.0148	0.0322	0.0410
	20 (68)	0.0036	0.0116	0.0256	
	25 (77)	0.0035	0.0095	0.0209	
	30 (86)	0.0034	0.0086	0.0172	
50%	15 (59)	0.0030	0.0087	0.0191	0.0260
	20 (68)	0.0020	0.0074	0.0153	
	25 (77)	0.0029	0.0072	0.0135	
	30 (86)	0.0028	0.0071	0.0130	
70%	15 (50)	0.0027	0.0068	0.0138	0.0184
	20 (68)	0.0026	0.0065	0.0122	
	25 (77)	0.0026	0.0064	0.0118	
	30 (86)	0.0025	0.0063	0.0117	

**(b) 4m (1/m)**

30%	15 (59)	0.0143	0.0486	0.1056	0.1360
	20 (68)	0.0119	0.0379	0.0840	
	25 (77)	0.0114	0.0313	0.0685	
	30 (86)	0.0111	0.0281	0.0564	
50%	15 (59)	0.0099	0.0286	0.0626	0.0860
	20 (68)	0.0096	0.0244	0.0503	
	25 (77)	0.0095	0.0235	0.0444	
	30 (86)	0.0092	0.0233	0.0426	
70%	15 (59)	0.0088	0.0223	0.0454	0.0600
	20 (68)	0.0085	0.0213	0.0399	
	25 (77)	0.0084	0.0211	0.0388	
	30 (86)	0.0082	0.0207	0.0383	